

WHAT IS CLAIMED IS:

1. A focussed beam antenna array comprising a plurality of element antennas and a feeding network connecting said element antennas and one or more microwave sources and providing a feeding coefficient for each element antenna, wherein either one or both of:

5 the relative position of the element antennas, and
 the feeding coefficient for each element antenna

are selected to cause microwave signals transmitted from the antenna array to focus on a required focal surface.

2. A focussed beam antenna array as claimed in claim 1 wherein the relative
10 position of the element antennas or the feeding coefficient for each element antenna, or the relative position of the element antennas and the feeding coefficient for each element antenna is selected to position the beam waist in a predetermined position in a transversal plane relative to the direction of propagation of said microwave signals.

3. A focussed beam antenna array as claimed in claim 1 wherein the required focal
15 surface is at a predetermined focal distance within the near field zone from the element antennas.

4. A focussed beam antenna array as claimed in claim 1 wherein said feeding network includes a power divider or network of power dividers between said one or more sources and said element antennas, so that each element antenna is fed with microwave
20 signals of substantially equal amplitude.

5. A focussed beam antenna array as claimed in claim 1 wherein the element antennas are located relative to each other in a preselected configuration, the configuration selected to assist the focussing of said electromagnetic signals transmitted from said element antennas.

25 6. A focussed beam antenna array as claimed in claim 1 wherein the element antennas are located at a separation of approximately one wavelength of the transmitted microwave signals from each other.

7. A focussed beam antenna array as claimed in claim 1 wherein the feeding coefficient for each element antenna is determined to cause a phase variation in signals
30 received by the element antennas that is substantially equivalent to the phase variation that

would occur in signals transmitted through a portion of a dielectric thin lens having the same radial distance as the element antenna.

8. A focussed beam antenna array as claimed in claim 1 wherein the feeding network may include controlled electronic phase shifters controlled by control means to
5 allow variation of the location of the focal surface.

9. A focussed beam antenna array as claimed in claim 1 wherein the antenna array includes no refractive elements.

10. A method of producing a focussed beam antenna array, the method comprising providing one or more element antennas for receiving microwave signals from a microwave
10 source and transmitting microwave signals, wherein the method includes one or both of:

locating the element antennas at certain locations relative to each other; and

selecting a certain feeding coefficient for each element antenna

in order to achieve a phase variation in microwave signals across the antenna array that causes the antenna array to have a predetermined focal surface at a required distance
15 from said element antennas.

11. A method as claimed in claim 10 comprising selecting the feeding coefficients for each element antenna to position the beam waist in a required position in a transversal plane relative to the direction of propagation of said microwave signals.

12. A method as claimed in claim 10 comprising locating the element antennas with
20 varying separation in a plane transverse to a direction of transmission of the antenna array in order to achieve a focussing effect.

13. A method as claimed in claim 10 comprising locating the element antennas at different locations along the axis of transmission of the antenna array in order to achieve a focussing effect.

25 14. A method as claimed in claim 10 wherein the focal surface is located within the near field zone of said antenna array.

15. A method as claimed in claims 10 comprising selecting the feeding coefficient for each element antenna so that the antenna array simulates a dielectric thin film lens.

16. A method as claimed in claim 10 comprising one or both of:

- (i) changing the electrical length of transmission lines to each antenna element; and
- (ii) using phase shifters to set the feeding coefficient for each element antenna.

17. A sensor for sensing a property of an object, the sensor comprising:

- a) a focussed beam transmitting antenna array comprising a plurality of element
5 antennas and a feeding network connecting said element antennas and one or more
microwave sources and providing a feeding coefficient for each element antenna, wherein
either one or both of the relative position of the element antennas, and the feeding
coefficient for each element antenna are selected to cause microwave signals transmitted
from the antenna array to focus on the object;
- 10 b) a receiving antenna to receive microwave signals that have passed through the
object; and
- c) a detection means to determine an indication of the property of the object.

18. A sensor as claimed in claim 17 wherein the detection means determines an
indication of an electrical property of the object.

15 19. A sensor as claimed in claim 18 wherein the electrical property is permitivity.

20. A sensor as claimed in claim 17 wherein the property includes one or more of
permittivity, moisture content, density.

21. A sensor as claimed in claim 17 wherein the detection means includes means to
compare the detected indication with a reference indication and provide a signal if the
20 detected indication is greater then or less than the reference indication.

22. A method of sensing a property of an object, the method comprising:

- a) providing one or more element antennas for receiving microwave signals from a
microwave source; and
- b) performing one or both of:
25 locating the element antennas at selected locations relative to each other, and
selecting a certain feeding coefficient for each element antenna,

in order to achieve a phase variation in microwave signals across the antenna array
that causes the antenna array to have apredetermined focal surface at a required distance
from the element antennas;

- c) transmitting microwave signals from the array to the object so that the microwave signals transmitted from the antenna array focus on the object;
- d) receiving microwave signals that have passed through the object; and
- e) using the received signals to determine an indication of the property of the object.

5 23. A method as claimed in claim 22 further comprising the steps of comparing the detected indication with a reference indication and providing a signal if the detected indication is greater then or less than the reference indication.